

REMARKS

Claims 12-13, 15-18, and 28-29 are pending. Claims 12 and 15-17 have been amended. Claims 1-11 and 14 have been canceled. Attached hereto is a marked-up version of the changes made to the claims by the current amendment. The first page of the marked-up version is captioned "VERSION WITH MARKINGS TO SHOW CHANGES MADE".

Pending independent claims 12 and 28 recite a faceplate for use in semiconductor processing which combines a tapered surface with the presence of elongated slots. The combination of these features are effective to ensure deposition of a layer of homogenous thickness on the surface of the wafer. Specifically:

one consequence of the close proximity of showerhead 308 relative to wafer 302 may be an increase in downward flow of process gases near the edges of the wafer. The resulting increase in mass flow to the wafer edges may give rise to increased edge thickness 320a of deposited material 320.

* * *

Accordingly, an alternative embodiment of a showerhead of the present invention may use a face plate having a tapered profile to avoid increased edge thickness of deposited materials at close face plate-to-wafer spacings. (Emphasis added; page 9, lines 11-26)

The Examiner has rejected claims 12-18 and 28-29 as obvious in light of U.S. patent no. 6,302,965 to Umotoy et al. ("the Umotoy patent") considered in light of the U.S. patent application no. 2002/00000196 to Park ("the Park Application"). Specifically, the Examiner has combined the Umotoy patent (purportedly showing a faceplate with slots) with the Park Application (purportedly showing a tapered faceplate).

However, in order to establish a prima facie case of obviousness, there must be some suggestion or motivation in the references themselves to combine reference teachings: this teaching or suggestion to make the claimed combination must be found in the prior art, and not be based upon applicants disclosure. In re Vaeck, 947 F.2d 488 (Fed. Cir. 1991).

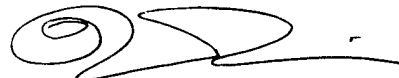
In the instant application, no such teaching or suggestion is found in the prior art relied upon by the Examiner to reject the pending claims 12-13, 15-18 and

28-29. Specifically, the Umotoy patent mentions only in very general terms that use of the faceplate will help ensure that a thin layer of material may be deposited uniformly across the wafer. (See col. 3, lines 27-28 and 63-64). Nowhere does the Umotoy patent recognize the nonuniformity in thickness of material deposited at the center and edge of the wafer addressed by the pending application. Moreover, nowhere does the Umotoy patent teach or suggest that such specific nonuniformity can be cured by altering an effective distance between the faceplate and the wafer, as described in the Park Application.

Because there is no teaching or suggestion in the Umotoy patent to combine it with the Park Application, the Examiner's rejection of claims 12-13, 15-18, and 28-29 as obvious is improper and should be withdrawn.

In view of the foregoing, Applicants believe all claims now pending in this Application are in condition for allowance. The issuance of a formal Notice of Allowance at an early date is respectfully requested. If the Examiner believes a telephone conference would expedite prosecution of this application, please telephone the undersigned at 650-326-2400.

Respectfully submitted,



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VERSION WITH MARKINGS TO SHOW CHANGES MADE

In the Drawings:

Figure 1A is amended in the manner shown in red in the replacement drawing sheet attached hereto.

In the Specification:

Paragraph [55] of the specification is amended to read as follows:

[55] FIGS. 7A-7D show simplified bottom views of the outlet portion of a variety of alternative embodiments of gas distribution face plates in accordance with the present invention, each bearing different orientations of elongated slots. Face plate outlet portion 660 of FIG. 7A bears a plurality of non-continuous slots 662 oriented in a circumferential direction. Face plate outlet portion 664 of FIG. 7B bears a plurality of non-continuous slots [466] 666 oriented in a radial direction. Face plate outlet portion 668 of FIG. 7C bears a plurality of non-continuous slots 670 that are exclusively oriented neither concentrically nor in a radial direction. Face plate outlet portion 672 of FIG. 7D bears a plurality of non-continuous slots 674 in combination with conventional holes 676.

In the Claims:

12. (Amended) An apparatus for forming a material on a semiconductor wafer, the apparatus comprising:

- a processing chamber defined by walls;
- a wafer support positioned within the processing chamber and configured to receive a semiconductor wafer;
- a processing gas supply; and
- a gas distribution showerhead overlying the wafer support and including a tapered face plate proximate to the wafer support, an edge of the tapered face plate exhibiting a reduced thickness relative to a thickness of a center of the face plate to create

a taper angle, such that material deposited on a wafer in contact with the wafer support exhibits a uniform center-to-edge thickness, the tapered faceplate further comprising, an inlet portion configured to receive a flow of a processing gas, the inlet portion comprising an aperture having a width, and an outlet portion configured to convey the processing gas flow to a semiconductor wafer, the outlet portion comprising an elongated slot in fluid communication with the aperture.

13. (Unchanged) The apparatus of claim 12 wherein the taper angle is between about 0.5° and 5°.

15. (Amended) The apparatus of claim [14] 12, wherein the elongated slot has a length at least one-half a thickness of the face plate.

16. (Amended) The apparatus of claim [14] 12 wherein the elongated slot is circular and continuous.

17. (Amended) The apparatus of claim [14] 12 wherein a width of the elongated slot is greater than the width of the aperture.

18. (Unchanged) The apparatus of claim 17 wherein the width of the elongated slot is at least 2.25x larger than the width of the aperture.

28. (Unchanged) An apparatus for forming a material on a semiconductor wafer, the apparatus comprising:

a processing chamber defined by walls;

a wafer support positioned within the processing chamber and configured to receive a semiconductor wafer;

a processing gas supply; and

a gas distribution showerhead overlying the wafer support and including a tapered face plate proximate to the wafer support, the tapered face plate comprising,

an inlet portion configured to receive a flow of a processing gas, the inlet portion comprising an aperture having a width, and

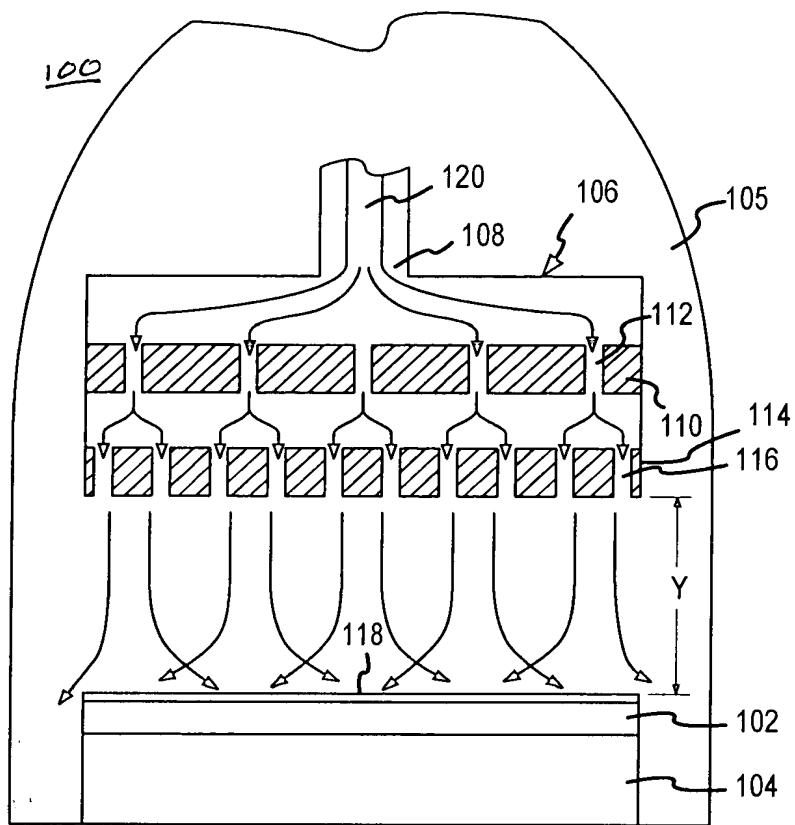
an outlet portion configured to convey the processing gas flow to a semiconductor wafer, the outlet portion comprising an elongated slot in fluid communication with the aperture,

wherein an edge of the tapered face plate exhibits a reduced thickness relative to a thickness of a center of the face plate to create a taper angle, such that material deposited on a wafer in contact with the wafer support exhibits a uniform center-to-edge thickness.

29. (Unchanged) The apparatus of claim 28 wherein the taper angle is between about 0.5° and 5° .

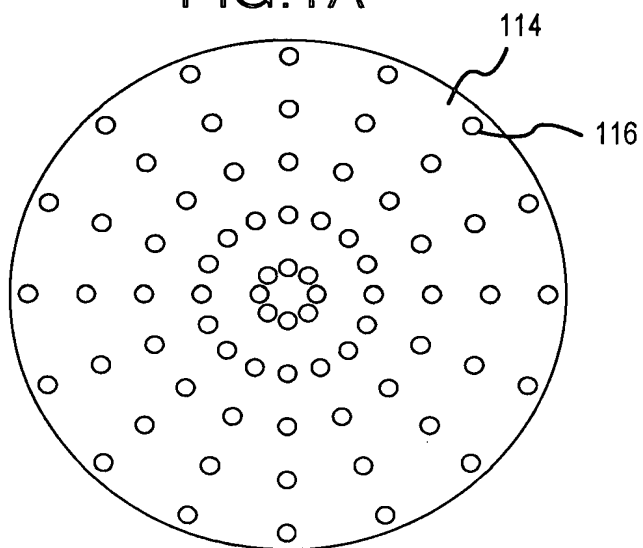


1/14



(PRIOR ART)

FIG.1A



(PRIOR ART)

FIG.1B